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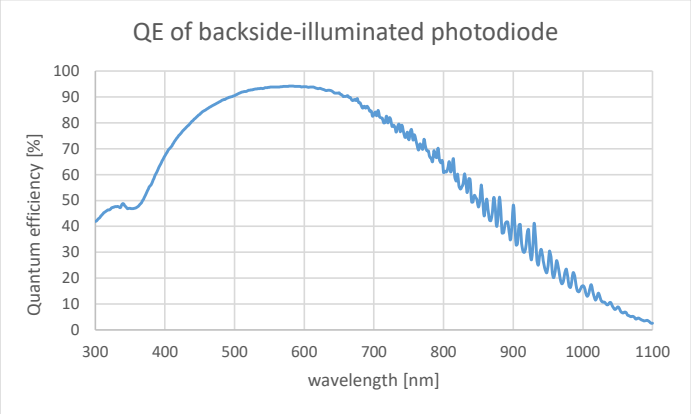
Proposal for Master Thesis

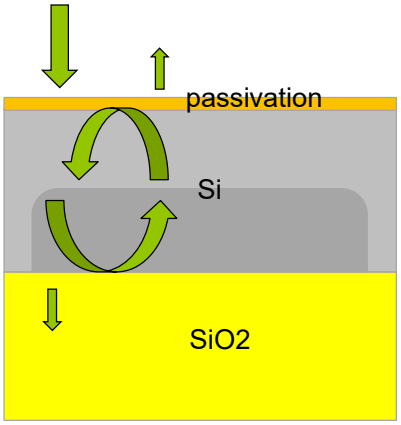
Photonics for a more perfect photodiode

Any semiconductor diode which is not shielded from the effects of light will behave as a photodiode. The photo-electric effect is universal in materials whose electronic properties align with those of the visible light spectrum.

These material properties (band gap, absorption), interface properties (reflection, ARC), semiconductor purity, interface and bulk state, device thickness, parallelism, and especially the design, allow us to tailor a semiconductor diode to become an efficient photo-active component.

Below plot is an example of the spectral response or quantum efficiency of a silicon photodiode, backside illuminated. The device reaches nearly 100% QE in the visible light spectrum, and features a high UV sensitivity.





The major weak point is the ‘etaloning’ or interference patterns in the near infrared region. For longer wavelengths, the absorption length of silicon increases and the silicon layer begins to behave as an optical cavity, causing interference.

The objectives of this thesis project are to:

- ← Measure and understand the quantum efficiency and the artifacts therein,
- ← Improve or optimize the solutions to the interference by design, simulation, optical modeling,
- ← Compare and select commercial optical simulation tools. Apply these tools to the present and other problems,
- ← Design novel photodiodes as a result of modeling and simulation.

Student background: electronic engineering, photonics, physics.

Please send your application letter and CV to jobs@caeleste.be.